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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/936,629	02/07/2002	Peter Maxwell	IO-1008US	7246

24923 7590 03/28/2003

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EXAMINER	
MCCLOUD, RENATA D	
ART UNIT	**PAPER NUMBER**
2837	

DATE MAILED: 03/28/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/936,629	MAXWELL ET AL.
	Examiner	Art Unit
	Renata McCloud	2837

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *07 February 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☐ Claim(s) *1-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1-22,24-26,28-30 and 33* is/are rejected.

7)☐ Claim(s) *23,27,31, and 32* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Specification

1. This application does not contain an abstract of the disclosure as required by 37 CFR 1.72(b). An abstract on a separate sheet is required.

2. The disclosure is objected to because of the following informalities: Application serial numbers and filing dates are missing on pages 11,12,14,19,20,32, and 41.

Appropriate correction is required.

Claim Objections

3. Claim 17 is objected to because of the following informalities: The claim recites the limitation "the acquisition" in. There is insufficient antecedent basis for this limitation in the claim.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 4 and 11-13 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably

convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The limitation "tilt" is not described in the specification.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

7. Claims 1-5,7 10, 11,15, 16, and 18-25, are rejected under 35 U.S.C. 102(e) as being anticipated by Tanenhaus et al (U.S. Patent 6,255,962).

Tanenhaus et al teach:

Claim 1: An apparatus for acquiring seismic data (e.g. Fig. 1), comprising: one or more sensor modules adapted to sense seismic energy (e.g. Fig. 1:MEMS1); and one seismic recorders coupled to the sensor module adapted to record seismic data indicative of seismic energy (e.g. Fig. 7:10''') wherein the sensor module comprises one or more accelerometers, and wherein the accelerometers have one or more axes of sensitivity (e.g. Col. 3:84).

Claim 2: the sensor modules comprise one or more micro-machined sensor elements (e.g. Fig. 1:MEMS1).

Claim 3: the sensor module further comprises a global positioning system receiver (e.g. Fig. 1:67).

Claim 4: a feedback control circuit adapted to provide force balanced feedback coupled to the sensor and for providing insensitivity gravity related signals (e.g. Col. 4:20-23); and a controller adapted to monitor the operation of the apparatus coupled to the sensor (e.g. Fig. 1:26; Col. 1: 55-60).

Claim 5: a controller coupled to the sensor module for controlling the operation of the apparatus (e.g. Fig. 1:26); wherein the sensor module comprises a 3-axis magnetometer for determining the orientation of the sensor module (e.g. Col. 4:24-28).

Claim 7: the sensor module provides a digital output signal (e.g. Fig. 1:22).

Claim10: A method of acquiring seismic data comprising: sensing seismic energy with one or more sensor modules (e.g. Fig. 1:MEMS1), wherein the one or more sensor modules comprise one or more accelerometers (e.g. e.g. Col. 3:84); and recording seismic data indicative of the seismic energy using a seismic recorder (e.g. Fig. 7:10''').

Claim 11: providing a forced feedback compensation to the sensor for providing insensitivity to gravity related signals (e.g. Col. 4:20-23).

Claim 15: synchronizing the operation of a seismic sensor module by using a global positioning system signal from a global positioning system receiver within the sensor module (e.g. Fig. 1:67).

Claim 16: determining the position of the seismic sensor by using a global positioning system signal from a global positioning system receiver within the sensor module (e.g. Col. 29-41).

Claim 18: determining the degree of coupling between the sensor module and the ground by generating a force (Col. 5:58-64); recording a response of the sensor assembly to the force; and analyzing the response (e.g. Col. 5:65-6:7).

Claim 21: sending a bitstream to a sensor module; decoding, capturing, and looping-back the bitstream to the seismic recorder; and capturing and analyzing the bitstream by the seismic recorder, wherein analyzing the bitstream comprises determining a malfunction of the sensor module (e.g. Col. 5:10-23).

Claim 22: using an ASIC coupled to a seismic recorder (e.g. Col. 6:59-65).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanenhaus et al as applied to claim 1 above, in view of Barr (U.S. Patent 6,512,980).

Claim 6: Tanenhaus et al teach the limitations of claim 1 and referring to claim 6, a controller coupled to the sensor module for controlling the operation of the apparatus (e.g. Fig1:26). Referring to claim 6, Tanenhaus et al do not teach a crystal assembly coupled to a sensor module for providing a force in order to measure the ground coupling and vector fidelity of the sensor. Barr teaches a crystal assembly coupled to a sensor module for providing a force in order to measure the ground coupling and vector fidelity of the sensor (Col. 5:5-42). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the seismic data acquisition apparatus taught by Tanenhaus et al to couple a crystal assembly to a sensor module as taught by Barr. The advantage of this would be improved effectiveness of sensors towed on streamers due to reducing signal noise coming from vibrations in stress members of the streamers.

10. Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanenhaus et al as applied to claim 1 above, in view of Ambs (U.S. Patent 6,028,817).

Claim 8: Tanenhaus et al teach the limitations of claim 1, and referring to claim 10, one seismic recorder (e.g. Fig. 7:10```). Tanenhaus et al do not teach the recorder being radio recorders. Ambs teaches the one or more seismic recorders are radio seismic recorders (e.g. Col. 2:14-25).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the seismic data acquisition apparatus taught by Tanenhaus et al to make the seismic recorders radio seismic recorders as taught by Ambs. The advantage of this would be the ability to send seismic data to a remote location.

Claim 9: Tanenhaus et al and Ambs teach the limitations of claim 8. Tanenhaus et al and Ambs teaches the limitations of claim 9 except for the radio seismic recorders being integral to the sensor modules.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the seismic data acquisition apparatus taught by Tanenhaus et al and Ambs to make the radio seismic recorders integral to the sensor modules, since it has been held that forming in an article which has formerly been formed in two pieces and put together involves only routine skill in the art. *Howard v. Detroit Stove Works*, 150 U.S. 164 (1893).

11. Claims 12-14,17,26,28-30, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanenhaus et al as applied to claim 1 above, in view of Rice, Jr. et al (U.S. Patent 4,068,208).

Claim 12: Tanenhaus et al teach the limitations of claim 11. Referring to claim 12, Tanenhaus et al do not teach determining the tilt angle of the sensor module; and measuring the steady-state gravity field over a predetermined time period. Rice, Jr. et al teach determining the tilt angle of the sensor module (Col. 4:67-54); and measuring the steady-state gravity field over a predetermined time period (Col. 8:12-21).

Claim 13: Tanenhaus et al teach the limitations of claim 11. Referring to claim 13, Tanenhaus et al do not teach calibrating the sensor module to determine gravity related information; storing the gravity related information within the sensor module; and measuring an effect of gravity on the sensor module (Col. 5:6-20). Rice Jr. et al teach calibrating the sensor module to determine gravity related information (Col. 4:67-54); storing the gravity related

information within the sensor module (Col. 8:20-25); and measuring an effect of gravity on the sensor module (Col. 5:6-20) .

Claim 14: Tanenhaus et al teach the limitations of claim 10. Referring to claim 14, Tanenhaus et al do not teach a method comprising: determining the orientation of the 3-axis sensor, comprising: performing a 3-dimensional measurement of a gravity field; determining a gravity vector; performing a 3-dimensional measurement of a magnetic field; determining a magnetic vector; and determining the direction of magnetic north and gravity down. Rice Jr. et al teach a method comprising: determining the orientation of the 3-axis sensor, comprising: performing a 3-dimensional measurement of a gravity field; determining a gravity vector; performing a 3-dimensional measurement of a magnetic field; determining a magnetic vector; and determining the direction of magnetic north and gravity down (e.g. Col. 7:9-26).

Claim 17: Tanenhaus et al teach the limitations of claim 10. Referring to claim 17, Tanenhaus et al do not teach synchronizing by receiving a signal containing time information; and controlling the operation of the one or more accelerometers and the one or more seismic recorders using the signal. Rice Jr. et al teach synchronizing the acquisition by receiving a signal containing time information; and controlling the operation of the one or more accelerometers and the one or more seismic recorders using the signal (Col. 7:65-8:10, the processor controls the accelerometers).

Claim 24: Tanenhaus et al teach the limitations of claim 10 and referring to claim 24, operating an accelerometer. Tanenhaus et al do not teach monitoring the accelerometer for instability to indicate a malfunction of the accelerometer. Rice Jr. et al teach monitoring the accelerometer for instability to indicate a malfunction of the accelerometer (Col. 15:67-16:30).

Claim 25: Tanenhaus et al teach the limitations of claim 10, and referring to claim 25 the use of an accelerometer (Fig. 3:84). Tanenhaus et al do not teach exciting the accelerometer with a bitstream; and acquiring, analyzing and judging an output signal generated by the accelerometer; wherein judging an output signal comprises judging a magnitude of the output signal to indicate a malfunction of the accelerometer. Rice Jr. et al teach exciting a geophone with a bitstream (Col. 7:65-8:21); and acquiring, analyzing and judging an output signal generated by the geophone (Col. 8:20-25); wherein judging an output signal comprises judging a magnitude of the output signal to indicate a malfunction of the accelerometer (Col. 13:18-34).

Claim 26: Tanenhaus et al teach the limitations of claim 25. Referring to claim 26, Tanenhaus et al do not teach judging an output signal comprises judging a phase response of the output signal to indicate a malfunction of the accelerometer. Rice Jr. et al teach judging an output signal comprises judging a phase response of the output signal to indicate a malfunction of the accelerometer (Col. 13:18-34).

Claim 28: Tanenhaus et al teach the limitations of claim 10. Referring to claim 28, Tanenhaus et al do not teach operating the accelerometer for a period of time and analyzing an output signal generated by the accelerometer; wherein analyzing an output signal comprises detecting an excessive root-mean-square amplitude response of the output signal to indicate a malfunction of the accelerometer or a noisy environment. Rice Jr. et al teach operating the accelerometer for a period of time and analyzing an output signal generated by the accelerometer; wherein analyzing an output signal comprises detecting an excessive root-mean-square amplitude response of the output signal to indicate a malfunction of the accelerometer or a noisy environment (Col. 16 10-45)

Claim 29: Tanenhaus et al teach the limitations of claim 10, and referring to claim 29, operating the accelerometer and analyzing an output signal generated by the accelerometer (Col. 9: 10-26). Tanenhaus et al do not teach analyzing an output signal by analyzing an offset and a gravity cancellation magnitude of the output signal to detect a change in the inclination of the accelerometer. Rice Jr. et al teach not teach analyzing an output signal by analyzing an offset and a gravity cancellation magnitude of the output signal to detect a change in the inclination of the accelerometer (Col. 11:14-55).

Claim 30: Tanenhaus et al teach the limitations of claim 10, and referring to claim 30, operating the accelerometers and monitoring one or more output signals generated by the accelerometers (Col. 9: 10-26). Tanenhaus et al do not teach monitoring one or more output signals generated by the accelerometers by monitoring a vector sum of the self-measured coefficients of gravity of the output signals to detect a malfunction of the sensor assembly. Rice Jr. et al teach wherein monitoring one or more output signals generated by the accelerometers comprises monitoring a vector sum of the self-measured coefficients of gravity of the output signals to detect a malfunction of the sensor assembly (Col. 15:67-16:30).

It would have been obvious to one having ordinary skill in the art at the invention was made to modify the seismic data acquiring method taught by Orban et al to include the teaching of Rice Jr. et al. The advantage of this would a method of acquiring seismic data wherein the complexity of the method is related to the accuracy of the desired results.

12. Claims 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanenhaus et al as applied to claim10 above, in view of Orban et al (WO 98/14800).

Claim 19: Tanenhaus et al teach the limitations of claim 10. Referring to claim 19, Tanenhaus et al do not teach determining a vector of the sensor module by generating a force; recording a response of the sensor assembly to the force; and analyzing the response. Orban et al teach determining a vector of the sensor module by generating a force; recording a response of the sensor assembly to the force; and analyzing the response (e.g. Col. 2:57-65).

Claim 20: Tanenhaus et al teach the limitations of claim 10. Referring to claim 20, Tanenhaus et al do not teach determining the orientation of the sensor module by generating a force at a plurality of source points; recording a response of the sensor module to the force; and analyzing the response. Orban et al teach determining the orientation of the sensor module by generating a force at a plurality of source points; recording a response of the sensor module to the force; and analyzing the response (e.g. Col. 2:57-65).

It would have been obvious to one having ordinary skill in the art at the invention was made to modify the seismic data acquiring method taught by Tanenhaus et al to include the teaching of Orban et al. The advantage of this would a method of acquiring seismic data with that allows proper acoustic coupling of sensors to the ground.

13. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanenhaus et al (U.S. Patent 6,255,962) and Orban et al (WO 98/14800), in view of Rice Jr. et al (U.S. Patent 4,068,208).

Claim 33: Tanenhaus et al teach the limitations of claim 10, and referring to claim 33, (a) operating the accelerometers (Col. 9: 10-26); (b) monitoring one or more output signals generated by the accelerometers (Col. 9: 10-26); (c) analyzing the output signals (Col. 9:10-26). Tanenhaus et al do not teach (d) changing the orientation of the sensor assembly (Col. 7:22-25); and (e) repeating (b), (c) and (d) for a plurality of orientations (Col. 7:22-25) or analyzing the output signals by calculating the sensor's angles with respect to gravity from a vector sum of the self-measured coefficients of gravity in any orientation; and wherein analyzing the output signals further comprises analyzing sensor's angles with respect to gravity to indicate a malfunction of the sensor assembly.

Orban et al teach (d) changing the orientation of the sensor assembly (Pg. 10, Par. 1); and (e) repeating (b), (c) and (d) for a plurality of orientations (Pg. 10, Par. 1). Orban et al do not teach analyzing the output signals by calculating the sensor's angles with respect to gravity from a vector sum of the self-measured coefficients of gravity in any orientation; and wherein analyzing the output signals further comprises analyzing sensor's angles with respect to gravity to indicate a malfunction of the sensor assembly.

Rice Jr. et al teach analyzing the output signals by calculating the sensor's angles with respect to gravity from a vector sum of the self-measured coefficients of gravity in any orientation (Col. 15:67-16:30); and wherein analyzing the output signals further comprises analyzing sensor's angles with respect to gravity to indicate a malfunction of the sensor assembly (Col. 16:10-45).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the seismic data acquiring method taught by Tanenhaus et al and

Orban et al to include the teachings of Rice Jr. et al. The advantage of this would a method of acquiring seismic data with that allows proper acoustic coupling of sensors to the ground and wherein the complexity of the method is related to the accuracy of the desired results.

Allowable Subject Matter

14. Claims 23, 27, 31, and 32 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The following is a statement of reasons for the indication of allowable subject matter: Prior Art of Record fails to teach a method of acquiring seismic data including validating contents of an ASIC, judging a total harmonic distortion of an output signal to indicate a malfunction of an accelerometer, monitoring the magnitude of a reference frequency in an output signal of an undriven accelerometer, or analyzing a peak and root mean square amplitude to indicate a malfunction of a sensor.

Conclusion

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Renata McCloud whose telephone number is (703) 308-1763. The examiner can normally be reached on Mon.-Thurs and every other Fri. from 8 am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Nappi can be reached on (703) 308-3370. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Renata McCloud
Examiner
Art Unit 2837

RDM
March 21, 2003

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